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ESTIMATING THE BENEFITS OF PERSONNEL SELECTION AND CLASSIFICATION: AN EXTENSION OF THE BROGDEN TABLE

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A Monte Carlo study was done to estimate the standardized performance gain (σ units) for personnel who have been optimally selected and classified as a function of (a) the number of alternative job assignments, (b) the applicant rejection rate, (c) the validity of the performance estimates, and (d) the intercorrelation among the estimates. The study extended the number of job assignment categories considered to 500 based on a general solution provided by Brogden (1959) for up to 10 jobs. Results indicated that adding job categories with zero applicant rejection improved expected performance from 0.0σ units with 1 job to 3.03 σ units with 500 jobs. For the highest level of applicant rejection (90%), corresponding gains were 1.75 σ units and 3.78 σ units respectively. Implications for use of the table were discussed.

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PREFACE

This research was conducted under Work Unit 77192024, Technology Development of Methods to Match People to Air Force Jobs. The authors wish to thank Malcolm Ree and James Earles of the Armstrong Laboratory Human Resources Directorate for critical review and comments on the paper and Elizabeth Knippa and Sharon McDonald for assistance in preparation of the manuscript.

ESTIMATING THE BENEFITS OF PERSONNEL SELECTION AND CLASSIFICATION: AN EXTENSION OF THE BROGDEN TABLE

I. INTRODUCTION

There has been long and continued interest in the topic of estimating benefits of personnel selection (Brogden, 1946; Brown & Ghiselli, 1953; Cronbach & Gleser, 1965; Jarrett, 1948; Naylor & Shine, 1965; Richardson, 1944; Taylor & Russell, 1939; and more recently, Murphy, 1986; Schmidt, Hunter, McKenzie, & Muldrow, 1979; and Schmidt, Mack, & Hunter, 1984). Much progress has been made to resolve technical issues associated with single-job selection and to extend the procedures toward consideration of dollar-valued utility (Cronbach & Gleser, 1965; Schmidt & Hunter, 1983; and Boudreau, 1988). Research on benefit estimation in the larger and more inclusive domain of simultaneous selection and classification into multiple-job systems has been slower to evolve (Johnson & Ziedner, 1990). In his review of the literature, Casio (1991) characterized the topic as having been, as yet, largely unexplored. Yet questions frequently arise in connection with large personnel programs concerning which of several alternative interventions might be expected to yield the most benefits. These interventions might include (a) recruiting efforts to expand the applicant pool in size or quality, (b) employing tests with greater validity to improve the accuracy of decision making, (c) structuring jobs to provide alternative assignment opportunities, (d) testing a wider diversity of domains to improve the differential (Brogden, 1951) nature of the selection tests, and (e) changing entry standards to accommodate different requirements and recruiting markets.

In a succession of papers beginning in 1946, Brogden (1946, 1951, 1954, 1955, 1959) began to describe the broad outlines of the more complex classification problem by deriving a general solution for estimating selection <u>and</u> classification benefits. Expected criterion performance of those personnel selected was characterized as varying according to the number of possible job assignments, the proportion of applicants rejected, and the validity and intercorrelation of the performance estimates (i.e., predicted scores). In 1959, Brogden published a table showing the expected performance in standard score metric ($\overline{A}_y$) for ten levels of applicant rejection rate (0.00 to .90) across 1 to 10 jobs. Tabled entries were computed on the basis of perfectly valid performance estimates and zero intercorrelation among estimates across jobs. An adjustment function $R\sqrt{1-r}$ was provided that applied to specific situations where <u>R</u> was defined as the actual validity of the performance estimates (prediction composites) and <u>r</u> was the intercorrelation among the estimates. Thus $\overline{Z}_y = \overline{A}_y(R\sqrt{1-r})$ where $\overline{Z}_y$ is the expected performance of the selected group adjusted for validity and composite intercorrelation. To make the problem tractable, it was further

assumed that all jobs had equal requirements for assigned personnel (quotas) and that all jobs were equally important.

As many applications of selection and classification technology may involve more than 10 assignment categories, especially in large military and industrial organizations or educational counseling settings, the major purpose of this paper was to extend the Brogden tables from 10 to 500 job categories. The extended table would have higher utility for judging potential benefits of planned enhancements to a selection and classification program.

II. METHOD

A Monte Carlo simulation approach was taken wherein a thousand samples of random normal deviates of size $\underline{h}_j(j = 1 \text{ to } 500)$ were generated for each job category. An average of the largest observation in each of the thousand samples served as the estimated performance value $(\overline{A}_y)$ for the situation where the rejection rate was zero. With one job to be filled and no applicant rejection, the expected performance (unit normal deviate) of a selectee is as likely to be negative as positive. Over a large number of such fills, the expected performance benefit would be zero (or average) in terms of normal deviates. With two jobs to be filled without applicant rejection, and using the rule that an applicant is assigned to the job with the higher expected performance, one can expect (for uncorrelated performance measures) that after a large number of fills, the overall expected performance for each job would be equal to the average of the highest of the two random values generated for each simulated applicant. Extension to any number of jobs justifies the selection of the higher deviate from each sample of deviates. For higher levels of applicant rejection, the distribution of the largest observations in each sample was progressively restricted to include the top 90% (10% rejection rate), the top 80% (20% rejection rate), etc., until only the top 10% in the samples was included (90% rejection rate).

The simulation was conducted using the RANNOR function from the Statistical Analysis System (SAS) library (SAS Institute Inc., 1985). RANNOR returns variates generated from a unit normal distribution with mean 0 and variance 1. Descriptive statistics on the aggregate random numbers generated for the smallest $(\underline{h} = 1)$ and largest $(\underline{h} = 500)$ sample sizes were obtained for comparison with expected characteristics of a normal distribution. Simulation results were also cross-checked with theoretical values provided by Tippett (1925) on which Brogden based his original findings. Tippett estimated the means and standard deviations of the largest observations in samples of varying size drawn from a normal population.

After expected performance values ($\bar{A}_y$) for all sample sizes and levels of selectivity were assembled, small random fluctuations were smoothed using curve fitting techniques to yield increasing monotonic functions across both rows (jobs) and columns (rejection rates) simultaneously. A complex polynomial regression function using number of jobs and level of rejection rate as independent variables was generated to predict the tabled values. The predicted scores from this model were then used to smooth (i.e., replace) the raw estimates. A correlation between entries in the final smoothed table and the simulation results was obtained to index goodness-of-fit.

III. RESULTS

Inspection of the summary statistics for the smallest and largest samples verified that the random function software was producing values with the expected range and distribution. Table 1 shows summary descriptive statistics for the sample sizes 1 and 500 ($N = 1000$).

Table 1
Descriptive Statistics for Mean Random Values Generated for Sample Sizes 1 and 500

Sample Size	No. of Samples	Mean	SD	Minimum	Maximum
1	1000	-.003	1.042	-3.251	3.262
500	1000	-.002	.045	- .129	.154

Note: Average standard deviation for 1000 samples of 500 was .9999. The obtained value $SD = .045$ for sample size 500 may be compared to the theoretical estimate from the formula $SD_m = 1/\sqrt{N} = 1/\sqrt{500} = .0447$.

Actual means and standard deviations were very close to the expected values. The distribution of 1000 observations of sample size = 1 was normal with skew = .036 and kurtosis = -.097. Both the smoothed and unsmoothed simulation results compared favorably with those of Tippett (1925) to two decimal places as shown in Table 2. The effect of smoothing was to bring the raw values into closer alignment with the theoretical values. The complex polynomial equation yielded a multiple R^2 value of .9968 for the 5000 observations in the table. The small amount of variance unaccounted for was attributed to random variation on the simulation process.

Results of the final smoothed estimates are shown in the Appendix. Inspection of Table A1 reveals that the effect of adding jobs produces a progressive increase in expected performance for all levels of applicant rejection, other factors being constant. For a rejection rate of zero, performance benefits begin at 0.0 and increase to 3.03 for 500 jobs --- a three standard deviation (σ)

Table 2
Means and Standard Deviations of the Largest Observations in Samples from a Normal Population

Sample Size	Theoretical[a] Mean	Theoretical[a] SD	Simulation ($N = 1000$) Obtained Mean	Simulation ($N = 1000$) Obtained SD	Simulation ($N = 1000$) Smoothed[b] Mean
5	1.163	.669	1.178	.663	1.16
10	1.539	.587	1.566	.587	1.54
20	1.867	.525	1.855	.512	1.87
60	2.319	.454	2.325	.447	2.32
100	2.508	.429	2.502	.424	2.51
200	2.746	.401	2.742	.397	2.75
500	3.037	.370	3.027	.382	3.03

a. From Tippett (1925)
b. Standard deviations were not smoothed

increase in expected performance. The increase due to the addition of each job is progressively less at each increment as Brogden had previously noted. Moving from 10 to 20 jobs with a zero rejection rate improves criterion performance .33σ units compared with 1.54 units between 1 to 10 jobs, all else being equal. Moving from left to right in the table, benefits improve as rejection rate increases from 0% rejected to 90% rejected across all levels of job categories. As would be expected, the increase in the first row (1.75σ units for a single job) was greater than that found in the last row (.75σ units for 500 jobs) if R and r remain constant.

It should be noted, however, that R and r would not typically remain constant as the number of job categories increases. For example, suppose that n job categories have been identified from a hierarchical clustering of a much larger number of component jobs. The expected increase in benefit between n and n+1 jobs would be a function of three separate effects: (a) the increase in opportunity for alternative assignments that Brogden predicted from adding an additional job, (b) a possible increase in average validity due to the additional performance prediction composite, and (c) a potential decrement in average correlation among the performance estimates if the new job category was sufficiently dissimilar to the n job categories already defined.

In working through some examples of how the extended table could be used, some anomalous estimates were obtained using the recommended adjustment factor for situations where both selection and classification operate simultaneously. When one compares for example the expected benefits for one job ($\underline{R}=.55$) vs two jobs where ($\underline{R}=.55$, $\underline{r}=.85$) and the percentage of applicants rejected is 60%, the single job estimate is .97(.55) or $.53\sigma$ units while the estimate for two jobs is $1.37(.55\sqrt{1-.85})$ or $.29\sigma$ units --- less than would be obtained using selection alone. This was counter-intuitive and led us toward efforts to verify some of the properties of the Brogden adjustment factor. The problem in the procedure derives from the fact that selection efficiency does not decrease (in fact, cannot decrease) as more jobs are included. Yet the original adjustment can yield this sort of discrepancy. Several simulations were conducted for varying numbers of jobs, rejection rates and composite intercorrelation values. Table 3 summarizes these comparisons.

It can be noted that the Brogden adjustment underestimates the potential benefits by varying degrees when two or more jobs are considered. An alternative procedure is to apply the Brogden adjustment to only those performance increments that can be obtained over and above those expected by selection alone. In practice, the $\overline{A}_y$ values in the table need to be separated into discrete selection ($\overline{A}_{ys}$) and classification ($\overline{A}_{yc}$) components where both $\overline{A}_y$ and $\overline{A}_{ys}$ are obtained from the Appendix. $\overline{A}_y$ is the overall benefit for a given number of jobs and applicant rejection level. $\overline{A}_{ys}$ is the benefit associated with selection alone (single job) from the first row of the corresponding column in which $\overline{A}_y$ appears. Then, $\overline{A}_{yc}=\overline{A}_y-\overline{A}_{ys}$. The revised adjustment procedure for differing values of $\underline{R}$ and $\underline{r}$ is given by:

$$\overline{Z}_y=\overline{A}_{ys}(R)+\overline{A}_{yc}(R\sqrt{1-r})$$

Estimates based on the revised procedure, also shown in Table 3, give a lower bound but more accurate forecast of overall benefits than the original procedure. Note that for situations where there is no applicant rejection (first column of Table A1 in the Appendix), $\overline{A}_{ys}=0$ and where there is only one job category (first row of Table A1 in the Appendix), $\overline{A}_{yc}=0$.

IV. DISCUSSION

The expanded table and revised adjustment procedure provide a planning baseline for determining what magnitudes of performance outcomes are feasible to obtain, given the situational parameters. The general classes of problems to which the table would apply can be illustrated with some examples.

(a) Given that the applicant rejection rate can be changed from .50 to .80, what gain in mean criterion performance would result? Assume that there are 4 jobs with an average validity of .50 and an average intercorrelation value of .70 among prediction composites.

Table 3

Comparison of Adjustment Procedures for $\underline{R}$ = 1.0

Condition				Estimated $\bar{Z}_y$	
Jobs	Reject	r	Empirical $\bar{Z}_y$	Brogden (%)	Revised (%)
2	40	.00	1.10	1.09 (99%)	1.09 (99%)
2	40	.45	1.00	.81 (81%)	.97 (97%)
2	40	.85	.85	.42 (49%)	.81 (95%)
2	60	.00	1.36	1.37 (101%)	1.37 (101%)
2	60	.45	1.28	1.02 (80%)	1.27 (99%)
2	60	.85	1.16	.53 (46%)	1.12 (97%)
4	40	.00	1.47	1.48 (101%)	1.48 (101%)
4	40	.45	1.30	1.10 (84%)	1.25 (97%)
4	40	.85	1.02	.57 (56%)	.97 (95%)
4	60	.00	1.71	1.71 (100%)	1.71 (100%)
4	60	.45	1.58	1.27 (80%)	1.52 (96%)
4	60	.85	1.32	.66 (50%)	1.26 (95%)
8	40	.00	1.81	1.81 (100%)	1.81 (100%)
8	40	.45	1.57	1.34 (85%)	1.51 (96%)
8	40	.85	1.17	.70 (60%)	1.09 (93%)
8	60	.00	2.01	2.03 (99%)	2.03 (99%)
8	60	.45	1.84	1.50 (82%)	1.76 (96%)
8	60	.85	1.48	.79 (53%)	1.38 (93%)
16	40	.00	2.10	2.11 (100%)	2.11 (100%)
16	40	.45	1.82	1.56 (86%)	1.73 (95%)
16	40	.85	1.29	.82 (63%)	1.21 (93%)
16	60	.00	2.28	2.31 (101%)	2.31 (101%)
16	60	.45	2.06	1.71 (83%)	1.96 (95%)
16	60	.85	1.59	.89 (56%)	1.49 (94%)

Solution: From Table A1, the optimum performance value $\overline{A}_y$ for four jobs under a rejection rate of .50 would be 1.59. The corresponding $\overline{A}_{ys}$ value for a single job would be .80 and $\overline{A}_{yc}$ (1.59 - .80) = .79. Therefore current performance $\overline{Z}_y$ = .80 (.50) + .79 (.50$\sqrt{1-.70}$) = .6164σ. Estimated performance with a rejection rate of .80 where $\overline{A}_y$ is 2.05, $\overline{A}_{ys}$ is 1.40 and $\overline{A}_{yc}$ is .65 would be 1.40 (.50) + .65 (50$\sqrt{1-.70}$) = .8780σ. Thus, increasing the rejection rate from .50 to .80 results in an anticipated improvement of (.8780 - .6164) .226σ units.

(b) Given some level of desired improvement in the average standard criterion score $\overline{Z}_y$ for those selected (e.g., .42σ to .60σ), what validity increase would be necessary to achieve it? Assume that there are three jobs to fill, average validity is .30, the intercorrelation of composites is .80, and that there is a .70 rejection rate.

Solution: Enter the table value for three jobs and .70 rejection rate. The current $\overline{Z}_y$ value is 1.16 (.30) + .57 (.30$\sqrt{1\text{-}.80}$) or .42σ units. Substituting the desired value (.60) in a rearrangement of this formula and solving for the unknown R value yields

$$R = \frac{\overline{Z}_y}{\overline{A}_{ys} + \overline{A}_{yc}\sqrt{1-r}}$$

$$R = \frac{.60}{1.16 + 57\sqrt{1-.80}}$$

$$R = .42$$

Thus the average validity of the composites must be increased from .30 to .42 without an increase in r to achieve the desired level of improvement in the criterion scores of those selected.

(c) Given that a single-job selection system has a rejection rate of .40 and validity of .50, what benefits would accrue from instituting an optimal classification system with 4 jobs? Assume that average validity remains the same and the expected intercorrelation of the composites is .70.

Solution: For a single job, the $\overline{A}_y$ value for a rejection rate of .40 is .64. In this case, $\overline{A}_{ys} = .64$ and $\overline{A}_{yc} = 0$. Current performance can be estimated by $\overline{Z}_y = .64(.50) = .32\sigma$ units. Entering the table value for four jobs with a rejection rate of .40 yields $\overline{A}_y = 1.48$. The corresponding selection component ($\overline{A}_{ys}$) is .64 and $\overline{A}_{yc}(1.48 - .64)$ is .84. Estimated mean criterion scores for the selected group would be $.64(.50) + .84\ (.50\sqrt{1-.70}) = .55\sigma$. Thus, an expected gain for the four-job system would be (.55σ - .32σ) .23σ units.

(d) Given that a classification program with four alternative assignment categories and a system-wide rejection rate of .60 yields current benefits of $.97(.40) + .74(.40\sqrt{1-.80}) = .52\sigma$ units, what is the expected performance gain if 20 alternative assignments were considered? Assume that the rejection rate remains at .60, the validity increases from .40 to .50, and the intercorrelation among the estimates declines from .80 to .70.

Solution: Current benefits from the system ($\overline{Z}_y$) are obtained by entering the table at 4 jobs and reading $\overline{A}_y = 1.71$ for a .60 rejection rate. $\overline{A}_{ys}$ would be .97 and $\overline{A}_{yc}$ would be .74. Adjusting for validity ($\underline{R}$) and interrcorrelation ($\underline{r}$) yields .52σ units shown above. Potential benefits can be estimated by locating the element corresponding to 20 jobs and a .60 rejection rate (2.39) and substituting in the basic formula with new values for $\overline{A}_{ys}$, $\overline{A}_{yc}$, $\underline{R}$, and $\underline{r}$. The adjustment formula yields an estimate of .87σ units or a 67% increase in performance.

Consider also that in the preceding examples, the mean standard score ($\overline{Z}_y$) can be substituted in the more traditional utility formulations of Brogden (1946), Cronbach and Gleser (1965), and Boudreau (1988) if performance can be converted to a dollar-valued metric (e.g., Schmidt & Hunter, 1983) and costs are known. Marginal utility can be defined:

$$\overline{\Delta U} = N_s T_s SD_y \overline{Z}_y - N_s (c / \varnothing)$$

where

$\overline{\Delta U}$ = marginal utility (net gain in utility resulting from the use of the new selection procedure)

N_s = number of applicants selected

T_s = average tenure of selected group

SD_y = standard deviation of dollar-valued job performance among randomly selected applicants

$\overline{Z}_y$ = mean standard criterion score for selectees

c = testing cost per applicant

$\varnothing$ = proportion of applicants selected (selection ratio).

V. CONCLUSION

In this paper an expanded framework has been described for conceptualizing the operation of a large selection and classification system — in particular, the likely effect of a range of situational parameters on expected overall performance. The framework addresses applications where there is a single-assignment category (job) and varying proportions of surplus applicants from which an employer may choose some and reject others (pure selection). The values in the first row of the Appendix correspond to those of Naylor and Shine (1965), albeit in abbreviated form. Situations that involve simultaneous assignment to multiple categories with no rejection of candidates (pure classification) are addressed in the first column of values where the number of alternative assignment categories range from 1 to 500. Remaining elements in the table apply to optimal selection and classification when varying degrees of applicant rejection may be operative. A revised adjustment procedure based on the validity and interrcorrelation of the performance estimates is suggested to obtain a more accurate forecast of expected benefits. Some caution should be exercised with the table inasmuch as it describes more or less ideal conditions. There are many practical constraints on real world classification systems that could affect expected outcomes, e.g., where applicant preferences are considered or where selectees may turn down offers of employment (Murphy, 1986). A prospective user should keep these factors in mind so that anticipated gains are not overstated.

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APPENDIX

EXTENSION OF THE BROGDEN TABLE

TABLE A1

Mean Standard Criterion Performance ($\overline{A}_y$) as a Function of Number of Jobs and Percent of Applicants Rejected (when R=1.0 and r= 0.0)

Number of Jobs	Percent of Applicants Rejected 0	10	20	30	40	50	60	70	80	90
1	0.00	0.20	0.35	0.50	0.64	0.80	0.97	1.16	1.40	1.75
2	0.56	0.73	0.85	0.97	1.09	1.22	1.37	1.54	1.75	2.07
3	0.85	0.99	1.10	1.21	1.32	1.44	1.57	1.73	1.93	2.23
4	1.03	1.17	1.27	1.37	1.48	1.59	1.71	1.86	2.05	2.35
5	1.16	1.29	1.39	1.49	1.59	1.70	1.82	1.95	2.14	2.43
6	1.27	1.38	1.48	1.58	1.68	1.78	1.90	2.04	2.22	2.51
7	1.35	1.46	1.56	1.65	1.75	1.86	1.97	2.10	2.28	2.55
8	1.42	1.53	1.63	1.72	1.81	1.91	2.03	2.16	2.33	2.60
9	1.49	1.59	1.68	1.77	1.86	1.96	2.07	2.20	2.38	2.64
10	1.54	1.65	1.73	1.82	1.91	2.01	2.11	2.24	2.41	2.68
11	1.59	1.70	1.79	1.88	1.97	2.06	2.15	2.29	2.46	2.71
12	1.63	1.74	1.83	1.92	2.02	2.10	2.19	2.33	2.51	2.73
13	1.67	1.77	1.86	1.95	2.05	2.12	2.22	2.37	2.54	2.75
14	1.70	1.80	1.89	1.98	2.07	2.15	2.26	2.40	2.56	2.77
15	1.74	1.83	1.92	2.01	2.09	2.17	2.29	2.42	2.58	2.78
16	1.77	1.86	1.95	2.04	2.11	2.20	2.31	2.44	2.60	2.80
17	1.79	1.88	1.97	2.05	2.13	2.22	2.33	2.46	2.62	2.82
18	1.82	1.90	1.99	2.07	2.15	2.25	2.35	2.48	2.64	2.84
19	1.84	1.94	2.02	2.10	2.18	2.27	2.37	2.50	2.66	2.86
20	1.87	1.94	2.04	2.12	2.20	2.29	2.39	2.52	2.68	2.88
21	1.89	1.96	2.06	2.14	2.22	2.31	2.41	2.54	2.70	2.89
22	1.91	1.98	2.08	2.16	2.24	2.32	2.43	2.56	2.72	2.91
23	1.93	2.00	2.10	2.18	2.26	2.34	2.44	2.57	2.73	2.92
24	1.95	2.02	2.12	2.20	2.27	2.36	2.46	2.59	2.74	2.94
25	1.97	2.04	2.13	2.21	2.29	2.37	2.47	2.60	2.76	2.95
26	1.98	2.05	2.15	2.23	2.30	2.39	2.49	2.61	2.77	2.96
27	2.00	2.07	2.16	2.24	2.32	2.40	2.50	2.63	2.78	2.97
28	2.01	2.08	2.18	2.26	2.33	2.41	2.51	2.64	2.80	2.99
29	2.03	2.10	2.19	2.27	2.34	2.43	2.53	2.65	2.81	3.00
30	2.04	2.11	2.21	2.28	2.36	2.44	2.54	2.66	2.82	3.01
31	2.06	2.13	2.22	2.30	2.37	2.45	2.55	2.67	2.83	3.02
32	2.07	2.14	2.23	2.31	2.38	2.46	2.56	2.68	2.84	3.03
33	2.08	2.15	2.25	2.32	2.39	2.47	2.57	2.69	2.85	3.04
34	2.09	2.17	2.26	2.33	2.40	2.48	2.58	2.70	2.86	3.04
35	2.11	2.18	2.27	2.34	2.41	2.49	2.59	2.71	2.87	3.05
36	2.12	2.19	2.28	2.35	2.42	2.50	2.60	2.72	2.88	3.06
37	2.13	2.20	2.29	2.36	2.43	2.51	2.61	2.73	2.88	3.07
38	2.14	2.21	2.30	2.37	2.44	2.52	2.62	2.74	2.89	3.08
39	2.15	2.22	2.31	2.38	2.45	2.53	2.63	2.75	2.90	3.09
40	2.16	2.23	2.32	2.39	2.46	2.54	2.64	2.76	2.91	3.09
41	2.17	2.24	2.33	2.40	2.47	2.55	2.64	2.77	2.92	3.10
42	2.18	2.25	2.34	2.41	2.48	2.56	2.65	2.77	2.92	3.11
43	2.19	2.26	2.35	2.42	2.49	2.57	2.66	2.78	2.93	3.11
44	2.20	2.27	2.36	2.43	2.50	2.57	2.67	2.79	2.94	3.12
45	2.21	2.28	2.37	2.44	2.50	2.58	2.68	2.79	2.94	3.13
46	2.22	2.29	2.37	2.44	2.51	2.59	2.68	2.80	2.95	3.13
47	2.22	2.29	2.38	2.45	2.52	2.60	2.69	2.81	2.96	3.14
48	2.23	2.30	2.39	2.46	2.53	2.60	2.70	2.81	2.96	3.15
49	2.24	2.31	2.40	2.47	2.53	2.61	2.70	2.82	2.97	3.15
50	2.25	2.32	2.40	2.47	2.54	2.62	2.71	2.83	2.97	3.16
51	2.25	2.33	2.41	2.48	2.55	2.62	2.72	2.83	2.98	3.16
52	2.26	2.33	2.42	2.49	2.55	2.63	2.72	2.84	2.99	3.17
53	2.27	2.34	2.43	2.50	2.56	2.64	2.73	2.84	2.99	3.17
54	2.28	2.35	2.43	2.50	2.57	2.64	2.73	2.85	3.00	3.18
55	2.28	2.35	2.44	2.51	2.57	2.65	2.74	2.86	3.00	3.18
56	2.29	2.36	2.45	2.52	2.58	2.65	2.75	2.86	3.01	3.19
57	2.30	2.37	2.45	2.52	2.59	2.66	2.75	2.87	3.01	3.19
58	2.30	2.37	2.46	2.53	2.59	2.67	2.76	2.87	3.02	3.20
59	2.31	2.38	2.47	2.53	2.60	2.67	2.76	2.88	3.02	3.20
60	2.32	2.39	2.47	2.54	2.60	2.68	2.77	2.88	3.03	3.21
61	2.32	2.39	2.48	2.55	2.61	2.68	2.77	2.89	3.03	3.21
62	2.33	2.40	2.48	2.55	2.61	2.69	2.78	2.89	3.04	3.22
63	2.34	2.41	2.49	2.56	2.62	2.69	2.78	2.90	3.04	3.22
64	2.34	2.41	2.49	2.56	2.63	2.70	2.79	2.90	3.05	3.23
65	2.35	2.42	2.50	2.57	2.63	2.70	2.79	2.91	3.05	3.23
66	2.35	2.42	2.51	2.57	2.64	2.71	2.80	2.91	3.06	3.23

TABLE A1
(Continued)

Number of Jobs	Percent of Applicants Rejected 0	10	20	30	40	50	60	70	80	90
67	2.36	2.43	2.51	2.58	2.64	2.71	2.80	2.92	3.06	3.24
68	2.36	2.43	2.52	2.58	2.65	2.72	2.81	2.92	3.06	3.24
69	2.37	2.44	2.52	2.59	2.65	2.72	2.81	2.92	3.07	3.25
70	2.38	2.44	2.53	2.59	2.66	2.73	2.81	2.93	3.07	3.25
71	2.38	2.45	2.53	2.60	2.66	2.73	2.82	2.93	3.08	3.25
72	2.39	2.45	2.54	2.60	2.66	2.73	2.82	2.94	3.08	3.26
73	2.39	2.46	2.54	2.61	2.67	2.74	2.83	2.94	3.08	3.26
74	2.40	2.46	2.55	2.61	2.67	2.74	2.83	2.94	3.09	3.26
75	2.40	2.47	2.55	2.62	2.68	2.75	2.84	2.95	3.09	3.27
76	2.41	2.47	2.56	2.62	2.68	2.75	2.84	2.95	3.10	3.27
77	2.41	2.48	2.56	2.63	2.69	2.76	2.84	2.96	3.10	3.28
78	2.42	2.48	2.57	2.63	2.69	2.76	2.85	2.96	3.10	3.28
79	2.42	2.49	2.57	2.63	2.69	2.76	2.85	2.96	3.11	3.28
80	2.43	2.49	2.57	2.64	2.70	2.77	2.86	2.97	3.11	3.29
81	2.43	2.50	2.58	2.64	2.70	2.77	2.86	2.97	3.11	3.29
82	2.44	2.50	2.58	2.65	2.71	2.78	2.86	2.97	3.12	3.29
83	2.44	2.51	2.59	2.65	2.71	2.78	2.87	2.98	3.12	3.30
84	2.44	2.51	2.59	2.65	2.71	2.78	2.87	2.98	3.12	3.30
85	2.45	2.51	2.60	2.66	2.72	2.79	2.87	2.99	3.13	3.30
86	2.45	2.52	2.60	2.66	2.72	2.79	2.88	2.99	3.13	3.30
87	2.46	2.52	2.60	2.67	2.73	2.79	2.88	2.99	3.13	3.31
88	2.46	2.53	2.61	2.67	2.73	2.80	2.88	3.00	3.14	3.31
89	2.47	2.53	2.61	2.67	2.73	2.80	2.89	3.00	3.14	3.31
90	2.47	2.54	2.62	2.68	2.74	2.81	2.89	3.00	3.14	3.32
91	2.47	2.54	2.62	2.68	2.74	2.81	2.89	3.00	3.15	3.32
92	2.48	2.54	2.62	2.69	2.74	2.81	2.90	3.01	3.15	3.32
93	2.48	2.55	2.63	2.69	2.75	2.82	2.90	3.01	3.15	3.33
94	2.49	2.55	2.63	2.69	2.75	2.82	2.90	3.01	3.15	3.33
95	2.49	2.55	2.63	2.70	2.75	2.82	2.91	3.02	3.16	3.33
96	2.49	2.56	2.64	2.70	2.76	2.83	2.91	3.02	3.16	3.33
97	2.50	2.56	2.64	2.70	2.76	2.83	2.91	3.02	3.16	3.34
98	2.50	2.57	2.64	2.71	2.76	2.83	2.92	3.03	3.17	3.34
99	2.50	2.57	2.65	2.71	2.77	2.83	2.92	3.03	3.17	3.34
100	2.51	2.57	2.65	2.71	2.77	2.84	2.92	3.03	3.17	3.34
101	2.51	2.58	2.65	2.72	2.77	2.84	2.93	3.03	3.17	3.35
102	2.52	2.58	2.66	2.72	2.78	2.84	2.93	3.04	3.18	3.35
103	2.52	2.58	2.66	2.72	2.78	2.85	2.93	3.04	3.18	3.35
104	2.52	2.59	2.66	2.73	2.78	2.85	2.93	3.04	3.18	3.36
105	2.53	2.59	2.67	2.73	2.79	2.85	2.94	3.05	3.18	3.36
106	2.53	2.59	2.67	2.73	2.79	2.86	2.94	3.05	3.19	3.36
107	2.53	2.60	2.67	2.74	2.79	2.86	2.94	3.05	3.19	3.36
108	2.54	2.60	2.68	2.74	2.80	2.86	2.95	3.05	3.19	3.37
109	2.54	2.60	2.68	2.74	2.80	2.86	2.95	3.06	3.20	3.37
110	2.54	2.61	2.68	2.74	2.80	2.87	2.95	3.06	3.20	3.37
111	2.55	2.61	2.69	2.75	2.80	2.87	2.95	3.06	3.20	3.37
112	2.55	2.61	2.69	2.75	2.81	2.87	2.96	3.06	3.20	3.37
113	2.55	2.62	2.69	2.75	2.81	2.88	2.96	3.07	3.20	3.38
114	2.56	2.62	2.70	2.76	2.81	2.88	2.96	3.07	3.21	3.38
115	2.56	2.62	2.70	2.76	2.82	2.88	2.96	3.07	3.21	3.38
116	2.56	2.62	2.70	2.76	2.82	2.88	2.97	3.07	3.21	3.38
117	2.57	2.63	2.70	2.76	2.82	2.89	2.97	3.08	3.21	3.39
118	2.57	2.63	2.71	2.77	2.82	2.89	2.97	3.08	3.22	3.39
119	2.57	2.63	2.71	2.77	2.83	2.89	2.97	3.08	3.22	3.39
120	2.57	2.64	2.71	2.77	2.83	2.89	2.98	3.08	3.22	3.39
121	2.58	2.64	2.72	2.78	2.83	2.90	2.98	3.09	3.22	3.40
122	2.58	2.64	2.72	2.78	2.83	2.90	2.98	3.09	3.23	3.40
123	2.58	2.64	2.72	2.78	2.84	2.90	2.98	3.09	3.23	3.40
124	2.59	2.65	2.72	2.78	2.84	2.90	2.99	3.09	3.23	3.40
125	2.59	2.65	2.73	2.79	2.84	2.91	2.99	3.10	3.23	3.40
126	2.59	2.65	2.73	2.79	2.84	2.91	2.99	3.10	3.23	3.41
127	2.59	2.66	2.73	2.79	2.85	2.91	2.99	3.10	3.24	3.41
128	2.60	2.66	2.73	2.79	2.85	2.91	3.00	3.10	3.24	3.41
129	2.60	2.66	2.74	2.80	2.85	2.92	3.00	3.10	3.24	3.41
130	2.60	2.66	2.74	2.80	2.85	2.92	3.00	3.11	3.24	3.41
131	2.61	2.67	2.74	2.80	2.86	2.92	3.00	3.11	3.25	3.42
132	2.61	2.67	2.74	2.80	2.86	2.92	3.00	3.11	3.25	3.42
133	2.61	2.67	2.75	2.81	2.86	2.92	3.01	3.11	3.25	3.42
134	2.61	2.67	2.75	2.81	2.86	2.93	3.01	3.12	3.25	3.42
135	2.62	2.68	2.75	2.81	2.87	2.93	3.01	3.12	3.25	3.42

TABLE A1
(Continued)

Number of Jobs	0	10	20	30	40	50	60	70	80	90
	Percent of Applicants Rejected									
136	2.62	2.68	2.75	2.81	2.87	2.93	3.01	3.12	3.26	3.43
137	2.62	2.68	2.76	2.82	2.87	2.93	3.02	3.12	3.26	3.43
138	2.62	2.68	2.76	2.82	2.87	2.94	3.02	3.12	3.26	3.43
139	2.63	2.69	2.76	2.82	2.88	2.94	3.02	3.13	3.26	3.43
140	2.63	2.69	2.76	2.82	2.88	2.94	3.02	3.13	3.26	3.43
141	2.63	2.69	2.77	2.83	2.88	2.94	3.02	3.13	3.27	3.44
142	2.63	2.69	2.77	2.83	2.88	2.94	3.03	3.13	3.27	3.44
143	2.64	2.70	2.77	2.83	2.88	2.95	3.03	3.13	3.27	3.44
144	2.64	2.70	2.77	2.83	2.89	2.95	3.03	3.14	3.27	3.44
145	2.64	2.70	2.78	2.83	2.89	2.95	3.03	3.14	3.27	3.44
146	2.64	2.70	2.78	2.84	2.89	2.95	3.03	3.14	3.28	3.44
147	2.65	2.71	2.78	2.84	2.89	2.96	3.04	3.14	3.28	3.45
148	2.65	2.71	2.78	2.84	2.89	2.96	3.04	3.14	3.28	3.45
149	2.65	2.71	2.79	2.84	2.90	2.96	3.04	3.15	3.28	3.45
150	2.65	2.71	2.79	2.84	2.90	2.96	3.04	3.15	3.28	3.45
151	2.66	2.72	2.79	2.85	2.90	2.96	3.04	3.15	3.28	3.45
152	2.66	2.72	2.79	2.85	2.90	2.97	3.05	3.15	3.29	3.46
153	2.66	2.72	2.79	2.85	2.90	2.97	3.05	3.15	3.29	3.46
154	2.66	2.72	2.80	2.85	2.91	2.97	3.05	3.15	3.29	3.46
155	2.66	2.72	2.80	2.86	2.91	2.97	3.05	3.16	3.29	3.46
156	2.67	2.73	2.80	2.86	2.91	2.97	3.05	3.16	3.29	3.46
157	2.67	2.73	2.80	2.86	2.91	2.98	3.06	3.16	3.29	3.46
158	2.67	2.73	2.80	2.86	2.91	2.98	3.06	3.16	3.30	3.47
159	2.67	2.73	2.81	2.86	2.92	2.98	3.06	3.16	3.30	3.47
160	2.68	2.73	2.81	2.87	2.92	2.98	3.06	3.17	3.30	3.47
161	2.68	2.74	2.81	2.87	2.92	2.98	3.06	3.17	3.30	3.47
162	2.68	2.74	2.81	2.87	2.92	2.98	3.06	3.17	3.30	3.47
163	2.68	2.74	2.81	2.87	2.92	2.99	3.07	3.17	3.31	3.47
164	2.68	2.74	2.82	2.87	2.93	2.99	3.07	3.17	3.31	3.48
165	2.69	2.75	2.82	2.88	2.93	2.99	3.07	3.17	3.31	3.48
166	2.69	2.75	2.82	2.88	2.93	2.99	3.07	3.18	3.31	3.48
167	2.69	2.75	2.82	2.88	2.93	2.99	3.07	3.18	3.31	3.48
168	2.69	2.75	2.82	2.88	2.93	3.00	3.07	3.18	3.31	3.48
169	2.69	2.75	2.83	2.88	2.94	3.00	3.08	3.18	3.32	3.48
170	2.70	2.76	2.83	2.88	2.94	3.00	3.08	3.18	3.32	3.49
171	2.70	2.76	2.83	2.89	2.94	3.00	3.08	3.18	3.32	3.49
172	2.70	2.76	2.83	2.89	2.94	3.00	3.08	3.19	3.32	3.49
173	2.70	2.76	2.83	2.89	2.94	3.00	3.08	3.19	3.32	3.49
174	2.70	2.76	2.84	2.89	2.94	3.01	3.09	3.19	3.32	3.49
175	2.71	2.76	2.84	2.89	2.95	3.01	3.09	3.19	3.32	3.49
176	2.71	2.77	2.84	2.90	2.95	3.01	3.09	3.19	3.33	3.49
177	2.71	2.77	2.84	2.90	2.95	3.01	3.09	3.19	3.33	3.50
178	2.71	2.77	2.84	2.90	2.95	3.01	3.09	3.20	3.33	3.50
179	2.71	2.77	2.85	2.90	2.95	3.01	3.09	3.20	3.33	3.50
180	2.72	2.77	2.85	2.90	2.96	3.02	3.10	3.20	3.33	3.50
181	2.72	2.78	2.85	2.90	2.96	3.02	3.10	3.20	3.33	3.50
182	2.72	2.78	2.85	2.91	2.96	3.02	3.10	3.20	3.34	3.50
183	2.72	2.78	2.85	2.91	2.96	3.02	3.10	3.20	3.34	3.50
184	2.72	2.78	2.85	2.91	2.96	3.02	3.10	3.21	3.34	3.51
185	2.73	2.78	2.86	2.91	2.96	3.02	3.10	3.21	3.34	3.51
186	2.73	2.79	2.86	2.91	2.97	3.03	3.10	3.21	3.34	3.51
187	2.73	2.79	2.86	2.92	2.97	3.03	3.11	3.21	3.34	3.51
188	2.73	2.79	2.86	2.92	2.97	3.03	3.11	3.21	3.34	3.51
189	2.73	2.79	2.86	2.92	2.97	3.03	3.11	3.21	3.35	3.51
190	2.73	2.79	2.86	2.92	2.97	3.03	3.11	3.21	3.35	3.51
191	2.74	2.79	2.87	2.92	2.97	3.03	3.11	3.22	3.35	3.52
192	2.74	2.80	2.87	2.92	2.98	3.04	3.11	3.22	3.35	3.52
193	2.74	2.80	2.87	2.93	2.98	3.04	3.12	3.22	3.35	3.52
194	2.74	2.80	2.87	2.93	2.98	3.04	3.12	3.22	3.35	3.52
195	2.74	2.80	2.87	2.93	2.98	3.04	3.12	3.22	3.35	3.52
196	2.74	2.80	2.87	2.93	2.98	3.04	3.12	3.22	3.36	3.52
197	2.75	2.80	2.88	2.93	2.98	3.04	3.12	3.22	3.36	3.52
198	2.75	2.81	2.88	2.93	2.98	3.04	3.12	3.23	3.36	3.53
199	2.75	2.81	2.88	2.93	2.99	3.05	3.12	3.23	3.36	3.53
200	2.75	2.81	2.88	2.94	2.99	3.05	3.13	3.23	3.36	3.53
201	2.75	2.81	2.88	2.94	2.99	3.05	3.13	3.23	3.36	3.53
202	2.76	2.81	2.88	2.94	2.99	3.05	3.13	3.23	3.36	3.53
203	2.76	2.81	2.89	2.94	2.99	3.05	3.13	3.23	3.37	3.53
204	2.76	2.82	2.89	2.94	2.99	3.05	3.13	3.23	3.37	3.53

TABLE A1
(Continued)

Number of Jobs	Percent of Applicants Rejected 0	10	20	30	40	50	60	70	80	90
205	2.76	2.82	2.89	2.94	3.00	3.06	3.13	3.24	3.37	3.54
206	2.76	2.82	2.89	2.95	3.00	3.06	3.13	3.24	3.37	3.54
207	2.76	2.82	2.89	2.95	3.00	3.06	3.14	3.24	3.37	3.54
208	2.76	2.82	2.89	2.95	3.00	3.06	3.14	3.24	3.37	3.54
209	2.77	2.82	2.90	2.95	3.00	3.06	3.14	3.24	3.37	3.54
210	2.77	2.83	2.90	2.95	3.00	3.06	3.14	3.24	3.38	3.54
211	2.77	2.83	2.90	2.95	3.00	3.06	3.14	3.24	3.38	3.54
212	2.77	2.83	2.90	2.95	3.01	3.07	3.14	3.25	3.38	3.54
213	2.77	2.83	2.90	2.96	3.01	3.07	3.14	3.25	3.38	3.55
214	2.77	2.83	2.90	2.96	3.01	3.07	3.15	3.25	3.38	3.55
215	2.78	2.83	2.90	2.96	3.01	3.07	3.15	3.25	3.38	3.55
216	2.78	2.83	2.91	2.96	3.01	3.07	3.15	3.25	3.38	3.55
217	2.78	2.84	2.91	2.96	3.01	3.07	3.15	3.25	3.38	3.55
218	2.78	2.84	2.91	2.96	3.01	3.07	3.15	3.25	3.39	3.55
219	2.78	2.84	2.91	2.96	3.02	3.08	3.15	3.25	3.39	3.55
220	2.78	2.84	2.91	2.97	3.02	3.08	3.15	3.26	3.39	3.55
221	2.79	2.84	2.91	2.97	3.02	3.08	3.16	3.26	3.39	3.56
222	2.79	2.84	2.91	2.97	3.02	3.08	3.16	3.26	3.39	3.56
223	2.79	2.84	2.92	2.97	3.02	3.08	3.16	3.26	3.39	3.56
224	2.79	2.85	2.92	2.97	3.02	3.08	3.16	3.26	3.39	3.56
225	2.79	2.85	2.92	2.97	3.02	3.08	3.16	3.26	3.39	3.56
226	2.79	2.85	2.92	2.97	3.03	3.08	3.16	3.26	3.40	3.56
227	2.79	2.85	2.92	2.98	3.03	3.09	3.16	3.26	3.40	3.56
228	2.80	2.85	2.92	2.98	3.03	3.09	3.16	3.27	3.40	3.56
229	2.80	2.85	2.92	2.98	3.03	3.09	3.17	3.27	3.40	3.57
230	2.80	2.86	2.93	2.98	3.03	3.09	3.17	3.27	3.40	3.57
231	2.80	2.86	2.93	2.98	3.03	3.09	3.17	3.27	3.40	3.57
232	2.80	2.86	2.93	2.98	3.03	3.09	3.17	3.27	3.40	3.57
233	2.80	2.86	2.93	2.98	3.03	3.09	3.17	3.27	3.40	3.57
234	2.80	2.86	2.93	2.99	3.04	3.09	3.17	3.27	3.41	3.57
235	2.81	2.86	2.93	2.99	3.04	3.10	3.17	3.27	3.41	3.57
236	2.81	2.86	2.93	2.99	3.04	3.10	3.17	3.28	3.41	3.57
237	2.81	2.86	2.94	2.99	3.04	3.10	3.18	3.28	3.41	3.57
238	2.81	2.87	2.94	2.99	3.04	3.10	3.18	3.28	3.41	3.58
239	2.81	2.87	2.94	2.99	3.04	3.10	3.18	3.28	3.41	3.58
240	2.81	2.87	2.94	2.99	3.04	3.10	3.18	3.28	3.41	3.58
241	2.81	2.87	2.94	2.99	3.04	3.10	3.18	3.28	3.41	3.58
242	2.82	2.87	2.94	3.00	3.05	3.10	3.18	3.28	3.41	3.58
243	2.82	2.87	2.94	3.00	3.05	3.11	3.18	3.28	3.42	3.58
244	2.82	2.87	2.94	3.00	3.05	3.11	3.18	3.29	3.42	3.58
245	2.82	2.88	2.95	3.00	3.05	3.11	3.19	3.29	3.42	3.58
246	2.82	2.88	2.95	3.00	3.05	3.11	3.19	3.29	3.42	3.58
247	2.82	2.88	2.95	3.00	3.05	3.11	3.19	3.29	3.42	3.59
248	2.82	2.88	2.95	3.00	3.05	3.11	3.19	3.29	3.42	3.59
249	2.82	2.88	2.95	3.00	3.05	3.11	3.19	3.29	3.42	3.59
250	2.83	2.88	2.95	3.01	3.06	3.11	3.19	3.29	3.42	3.59
251	2.83	2.88	2.95	3.01	3.06	3.12	3.19	3.29	3.43	3.59
252	2.83	2.88	2.95	3.01	3.06	3.12	3.19	3.29	3.43	3.59
253	2.83	2.89	2.96	3.01	3.06	3.12	3.19	3.30	3.43	3.59
254	2.83	2.89	2.96	3.01	3.06	3.12	3.20	3.30	3.43	3.59
255	2.83	2.89	2.96	3.01	3.06	3.12	3.20	3.30	3.43	3.59
256	2.83	2.89	2.96	3.01	3.06	3.12	3.20	3.30	3.43	3.60
257	2.83	2.89	2.96	3.01	3.06	3.12	3.20	3.30	3.43	3.60
258	2.84	2.89	2.96	3.02	3.07	3.12	3.20	3.30	3.43	3.60
259	2.84	2.89	2.96	3.02	3.07	3.13	3.20	3.30	3.43	3.60
260	2.84	2.89	2.96	3.02	3.07	3.13	3.20	3.30	3.44	3.60
261	2.84	2.90	2.97	3.02	3.07	3.13	3.20	3.30	3.44	3.60
262	2.84	2.90	2.97	3.02	3.07	3.13	3.20	3.31	3.44	3.60
263	2.84	2.90	2.97	3.02	3.07	3.13	3.21	3.31	3.44	3.60
264	2.84	2.90	2.97	3.02	3.07	3.13	3.21	3.31	3.44	3.60
265	2.84	2.90	2.97	3.02	3.07	3.13	3.21	3.31	3.44	3.61
266	2.85	2.90	2.97	3.03	3.07	3.13	3.21	3.31	3.44	3.61
267	2.85	2.90	2.97	3.03	3.08	3.13	3.21	3.31	3.44	3.61
268	2.85	2.90	2.97	3.03	3.08	3.14	3.21	3.31	3.44	3.61
269	2.85	2.91	2.98	3.03	3.08	3.14	3.21	3.31	3.44	3.61
270	2.85	2.91	2.98	3.03	3.08	3.14	3.21	3.31	3.45	3.61
271	2.85	2.91	2.98	3.03	3.08	3.14	3.21	3.32	3.45	3.61
272	2.85	2.91	2.98	3.03	3.08	3.14	3.22	3.32	3.45	3.61
273	2.85	2.91	2.98	3.03	3.08	3.14	3.22	3.32	3.45	3.61

TABLE A1
(Continued)

Number of Jobs	0	10	20	30	40	50	60	70	80	90
	Percent of Applicants Rejected									
274	2.86	2.91	2.98	3.03	3.08	3.14	3.22	3.32	3.45	3.61
275	2.86	2.91	2.98	3.04	3.08	3.14	3.22	3.32	3.45	3.62
276	2.86	2.91	2.98	3.04	3.09	3.14	3.22	3.32	3.45	3.62
277	2.86	2.91	2.98	3.04	3.09	3.15	3.22	3.32	3.45	3.62
278	2.86	2.92	2.99	3.04	3.09	3.15	3.22	3.32	3.45	3.62
279	2.86	2.92	2.99	3.04	3.09	3.15	3.22	3.32	3.45	3.62
280	2.86	2.92	2.99	3.04	3.09	3.15	3.22	3.33	3.46	3.62
281	2.86	2.92	2.99	3.04	3.09	3.15	3.23	3.33	3.46	3.62
282	2.86	2.92	2.99	3.04	3.09	3.15	3.23	3.33	3.46	3.62
283	2.87	2.92	2.99	3.04	3.09	3.15	3.23	3.33	3.46	3.62
284	2.87	2.92	2.99	3.05	3.09	3.15	3.23	3.33	3.46	3.62
285	2.87	2.92	2.99	3.05	3.10	3.15	3.23	3.33	3.46	3.63
286	2.87	2.92	2.99	3.05	3.10	3.15	3.23	3.33	3.46	3.63
287	2.87	2.93	3.00	3.05	3.10	3.16	3.23	3.33	3.46	3.63
288	2.87	2.93	3.00	3.05	3.10	3.16	3.23	3.33	3.46	3.63
289	2.87	2.93	3.00	3.05	3.10	3.16	3.23	3.33	3.46	3.63
290	2.87	2.93	3.00	3.05	3.10	3.16	3.23	3.34	3.47	3.63
291	2.87	2.93	3.00	3.05	3.10	3.16	3.24	3.34	3.47	3.63
292	2.88	2.93	3.00	3.05	3.10	3.16	3.24	3.34	3.47	3.63
293	2.88	2.93	3.00	3.05	3.10	3.16	3.24	3.34	3.47	3.63
294	2.88	2.93	3.00	3.06	3.10	3.16	3.24	3.34	3.47	3.63
295	2.88	2.93	3.00	3.06	3.11	3.16	3.24	3.34	3.47	3.64
296	2.88	2.94	3.01	3.06	3.11	3.16	3.24	3.34	3.47	3.64
297	2.88	2.94	3.01	3.06	3.11	3.17	3.24	3.34	3.47	3.64
298	2.88	2.94	3.01	3.06	3.11	3.17	3.24	3.34	3.47	3.64
299	2.88	2.94	3.01	3.06	3.11	3.17	3.24	3.34	3.47	3.64
300	2.88	2.94	3.01	3.06	3.11	3.17	3.24	3.34	3.48	3.64
301	2.89	2.94	3.01	3.06	3.11	3.17	3.25	3.35	3.48	3.64
302	2.89	2.94	3.01	3.06	3.11	3.17	3.25	3.35	3.48	3.64
303	2.89	2.94	3.01	3.06	3.11	3.17	3.25	3.35	3.48	3.64
304	2.89	2.94	3.01	3.07	3.11	3.17	3.25	3.35	3.48	3.64
305	2.89	2.94	3.01	3.07	3.12	3.17	3.25	3.35	3.48	3.64
306	2.89	2.95	3.02	3.07	3.12	3.17	3.25	3.35	3.48	3.65
307	2.89	2.95	3.02	3.07	3.12	3.18	3.25	3.35	3.48	3.65
308	2.89	2.95	3.02	3.07	3.12	3.18	3.25	3.35	3.48	3.65
309	2.89	2.95	3.02	3.07	3.12	3.18	3.25	3.35	3.48	3.65
310	2.89	2.95	3.02	3.07	3.12	3.18	3.25	3.35	3.48	3.65
311	2.90	2.95	3.02	3.07	3.12	3.18	3.25	3.36	3.49	3.65
312	2.90	2.95	3.02	3.07	3.12	3.18	3.26	3.36	3.49	3.65
313	2.90	2.95	3.02	3.07	3.12	3.18	3.26	3.36	3.49	3.65
314	2.90	2.95	3.02	3.08	3.12	3.18	3.26	3.36	3.49	3.65
315	2.90	2.95	3.02	3.08	3.13	3.18	3.26	3.36	3.49	3.65
316	2.90	2.96	3.02	3.08	3.13	3.18	3.26	3.36	3.49	3.65
317	2.90	2.96	3.03	3.08	3.13	3.18	3.26	3.36	3.49	3.66
318	2.90	2.96	3.03	3.08	3.13	3.19	3.26	3.36	3.49	3.66
319	2.90	2.96	3.03	3.08	3.13	3.19	3.26	3.36	3.49	3.66
320	2.90	2.96	3.03	3.08	3.13	3.19	3.26	3.36	3.49	3.66
321	2.91	2.96	3.03	3.08	3.13	3.19	3.26	3.36	3.49	3.66
322	2.91	2.96	3.03	3.08	3.13	3.19	3.26	3.37	3.50	3.66
323	2.91	2.96	3.03	3.08	3.13	3.19	3.27	3.37	3.50	3.66
324	2.91	2.96	3.03	3.09	3.13	3.19	3.27	3.37	3.50	3.66
325	2.91	2.96	3.03	3.09	3.13	3.19	3.27	3.37	3.50	3.66
326	2.91	2.97	3.03	3.09	3.14	3.19	3.27	3.37	3.50	3.66
327	2.91	2.97	3.04	3.09	3.14	3.19	3.27	3.37	3.50	3.66
328	2.91	2.97	3.04	3.09	3.14	3.19	3.27	3.37	3.50	3.66
329	2.91	2.97	3.04	3.09	3.14	3.20	3.27	3.37	3.50	3.67
330	2.91	2.97	3.04	3.09	3.14	3.20	3.27	3.37	3.50	3.67
331	2.91	2.97	3.04	3.09	3.14	3.20	3.27	3.37	3.50	3.67
332	2.92	2.97	3.04	3.09	3.14	3.20	3.27	3.37	3.50	3.67
333	2.92	2.97	3.04	3.09	3.14	3.20	3.27	3.37	3.50	3.67
334	2.92	2.97	3.04	3.09	3.14	3.20	3.28	3.38	3.51	3.67
335	2.92	2.97	3.04	3.09	3.14	3.20	3.28	3.38	3.51	3.67
336	2.92	2.97	3.04	3.10	3.14	3.20	3.28	3.38	3.51	3.67
337	2.92	2.98	3.04	3.10	3.15	3.20	3.28	3.38	3.51	3.67
338	2.92	2.98	3.05	3.10	3.15	3.20	3.28	3.38	3.51	3.67
339	2.92	2.98	3.05	3.10	3.15	3.20	3.28	3.38	3.51	3.67
340	2.92	2.98	3.05	3.10	3.15	3.21	3.28	3.38	3.51	3.67
341	2.92	2.98	3.05	3.10	3.15	3.21	3.28	3.38	3.51	3.68
342	2.92	2.98	3.05	3.10	3.15	3.21	3.28	3.38	3.51	3.68

TABLE A1
(Continued)

Number of Jobs	0	10	20	30	40	50	60	70	80	90
	Percent of Applicants Rejected									
343	2.93	2.98	3.05	3.10	3.15	3.21	3.28	3.38	3.51	3.68
344	2.93	2.98	3.05	3.10	3.15	3.21	3.28	3.38	3.51	3.68
345	2.93	2.98	3.05	3.10	3.15	3.21	3.28	3.38	3.51	3.68
346	2.93	2.98	3.05	3.10	3.15	3.21	3.29	3.39	3.52	3.68
347	2.93	2.98	3.05	3.11	3.15	3.21	3.29	3.39	3.52	3.68
348	2.93	2.98	3.05	3.11	3.15	3.21	3.29	3.39	3.52	3.68
349	2.93	2.99	3.05	3.11	3.16	3.21	3.29	3.39	3.52	3.68
350	2.93	2.99	3.06	3.11	3.16	3.21	3.29	3.39	3.52	3.68
351	2.93	2.99	3.06	3.11	3.16	3.21	3.29	3.39	3.52	3.68
352	2.93	2.99	3.06	3.11	3.16	3.22	3.29	3.39	3.52	3.68
353	2.93	2.99	3.06	3.11	3.16	3.22	3.29	3.39	3.52	3.69
354	2.94	2.99	3.06	3.11	3.16	3.22	3.29	3.39	3.52	3.69
355	2.94	2.99	3.06	3.11	3.16	3.22	3.29	3.39	3.52	3.69
356	2.94	2.99	3.06	3.11	3.16	3.22	3.29	3.39	3.52	3.69
357	2.94	2.99	3.06	3.11	3.16	3.22	3.29	3.39	3.52	3.69
358	2.94	2.99	3.06	3.11	3.16	3.22	3.30	3.40	3.53	3.69
359	2.94	2.99	3.06	3.12	3.16	3.22	3.30	3.40	3.53	3.69
360	2.94	2.99	3.06	3.12	3.16	3.22	3.30	3.40	3.53	3.69
361	2.94	3.00	3.06	3.12	3.17	3.22	3.30	3.40	3.53	3.69
362	2.94	3.00	3.07	3.12	3.17	3.22	3.30	3.40	3.53	3.69
363	2.94	3.00	3.07	3.12	3.17	3.22	3.30	3.40	3.53	3.69
364	2.94	3.00	3.07	3.12	3.17	3.22	3.30	3.40	3.53	3.69
365	2.94	3.00	3.07	3.12	3.17	3.23	3.30	3.40	3.53	3.69
366	2.94	3.00	3.07	3.12	3.17	3.23	3.30	3.40	3.53	3.70
367	2.95	3.00	3.07	3.12	3.17	3.23	3.30	3.40	3.53	3.70
368	2.95	3.00	3.07	3.12	3.17	3.23	3.30	3.40	3.53	3.70
369	2.95	3.00	3.07	3.12	3.17	3.23	3.30	3.40	3.53	3.70
370	2.95	3.00	3.07	3.12	3.17	3.23	3.30	3.40	3.53	3.70
371	2.95	3.00	3.07	3.12	3.17	3.23	3.31	3.41	3.54	3.70
372	2.95	3.00	3.07	3.13	3.17	3.23	3.31	3.41	3.54	3.70
373	2.95	3.01	3.07	3.13	3.17	3.23	3.31	3.41	3.54	3.70
374	2.95	3.01	3.07	3.13	3.18	3.23	3.31	3.41	3.54	3.70
375	2.95	3.01	3.08	3.13	3.18	3.23	3.31	3.41	3.54	3.70
376	2.95	3.01	3.08	3.13	3.18	3.23	3.31	3.41	3.54	3.70
377	2.95	3.01	3.08	3.13	3.18	3.23	3.31	3.41	3.54	3.70
378	2.95	3.01	3.08	3.13	3.18	3.24	3.31	3.41	3.54	3.70
379	2.96	3.01	3.08	3.13	3.18	3.24	3.31	3.41	3.54	3.70
380	2.96	3.01	3.08	3.13	3.18	3.24	3.31	3.41	3.54	3.71
381	2.96	3.01	3.08	3.13	3.18	3.24	3.31	3.41	3.54	3.71
382	2.96	3.01	3.08	3.13	3.18	3.24	3.31	3.41	3.54	3.71
383	2.96	3.01	3.08	3.13	3.18	3.24	3.31	3.41	3.54	3.71
384	2.96	3.01	3.08	3.13	3.18	3.24	3.31	3.41	3.54	3.71
385	2.96	3.01	3.08	3.14	3.18	3.24	3.32	3.42	3.55	3.71
386	2.96	3.01	3.08	3.14	3.18	3.24	3.32	3.42	3.55	3.71
387	2.96	3.02	3.08	3.14	3.19	3.24	3.32	3.42	3.55	3.71
388	2.96	3.02	3.09	3.14	3.19	3.24	3.32	3.42	3.55	3.71
389	2.96	3.02	3.09	3.14	3.19	3.24	3.32	3.42	3.55	3.71
390	2.96	3.02	3.09	3.14	3.19	3.24	3.32	3.42	3.55	3.71
391	2.96	3.02	3.09	3.14	3.19	3.24	3.32	3.42	3.55	3.71
392	2.96	3.02	3.09	3.14	3.19	3.25	3.32	3.42	3.55	3.71
393	2.97	3.02	3.09	3.14	3.19	3.25	3.32	3.42	3.55	3.71
394	2.97	3.02	3.09	3.14	3.19	3.25	3.32	3.42	3.55	3.72
395	2.97	3.02	3.09	3.14	3.19	3.25	3.32	3.42	3.55	3.72
396	2.97	3.02	3.09	3.14	3.19	3.25	3.32	3.42	3.55	3.72
397	2.97	3.02	3.09	3.14	3.19	3.25	3.32	3.42	3.55	3.72
398	2.97	3.02	3.09	3.14	3.19	3.25	3.32	3.42	3.55	3.72
399	2.97	3.02	3.09	3.15	3.19	3.25	3.33	3.43	3.56	3.72
400	2.97	3.02	3.09	3.15	3.19	3.25	3.33	3.43	3.56	3.72
401	2.97	3.03	3.09	3.15	3.19	3.25	3.33	3.43	3.56	3.72
402	2.97	3.03	3.10	3.15	3.20	3.25	3.33	3.43	3.56	3.72
403	2.97	3.03	3.10	3.15	3.20	3.25	3.33	3.43	3.56	3.72
404	2.97	3.03	3.10	3.15	3.20	3.25	3.33	3.43	3.56	3.72
405	2.97	3.03	3.10	3.15	3.20	3.25	3.33	3.43	3.56	3.72
406	2.97	3.03	3.10	3.15	3.20	3.26	3.33	3.43	3.56	3.72
407	2.98	3.03	3.10	3.15	3.20	3.26	3.33	3.43	3.56	3.72
408	2.98	3.03	3.10	3.15	3.20	3.26	3.33	3.43	3.56	3.73
409	2.98	3.03	3.10	3.15	3.20	3.26	3.33	3.43	3.56	3.73
410	2.98	3.03	3.10	3.15	3.20	3.26	3.33	3.43	3.56	3.73
411	2.98	3.03	3.10	3.15	3.20	3.26	3.33	3.43	3.56	3.73

TABLE A1
(Continued)

Number of Jobs	Percent of Applicants Rejected 0	10	20	30	40	50	60	70	80	90
412	2.98	3.03	3.10	3.15	3.20	3.26	3.33	3.43	3.56	3.73
413	2.98	3.03	3.10	3.15	3.20	3.26	3.34	3.43	3.56	3.73
414	2.98	3.03	3.10	3.16	3.20	3.26	3.34	3.44	3.57	3.73
415	2.98	3.04	3.10	3.16	3.20	3.26	3.34	3.44	3.57	3.73
416	2.98	3.04	3.10	3.16	3.21	3.26	3.34	3.44	3.57	3.73
417	2.98	3.04	3.11	3.16	3.21	3.26	3.34	3.44	3.57	3.73
418	2.98	3.04	3.11	3.16	3.21	3.26	3.34	3.44	3.57	3.73
419	2.98	3.04	3.11	3.16	3.21	3.26	3.34	3.44	3.57	3.73
420	2.98	3.04	3.11	3.16	3.21	3.26	3.34	3.44	3.57	3.73
421	2.98	3.04	3.11	3.16	3.21	3.27	3.34	3.44	3.57	3.73
422	2.99	3.04	3.11	3.16	3.21	3.27	3.34	3.44	3.57	3.73
423	2.99	3.04	3.11	3.16	3.21	3.27	3.34	3.44	3.57	3.74
424	2.99	3.04	3.11	3.16	3.21	3.27	3.34	3.44	3.57	3.74
425	2.99	3.04	3.11	3.16	3.21	3.27	3.34	3.44	3.57	3.74
426	2.99	3.04	3.11	3.16	3.21	3.27	3.34	3.44	3.57	3.74
427	2.99	3.04	3.11	3.16	3.21	3.27	3.34	3.44	3.57	3.74
428	2.99	3.04	3.11	3.16	3.21	3.27	3.34	3.44	3.57	3.74
429	2.99	3.04	3.11	3.17	3.21	3.27	3.35	3.45	3.58	3.74
430	2.99	3.04	3.11	3.17	3.21	3.27	3.35	3.45	3.58	3.74
431	2.99	3.05	3.11	3.17	3.21	3.27	3.35	3.45	3.58	3.74
432	2.99	3.05	3.11	3.17	3.22	3.27	3.35	3.45	3.58	3.74
433	2.99	3.05	3.12	3.17	3.22	3.27	3.35	3.45	3.58	3.74
434	2.99	3.05	3.12	3.17	3.22	3.27	3.35	3.45	3.58	3.74
435	2.99	3.05	3.12	3.17	3.22	3.27	3.35	3.45	3.58	3.74
436	2.99	3.05	3.12	3.17	3.22	3.27	3.35	3.45	3.58	3.74
437	2.99	3.05	3.12	3.17	3.22	3.28	3.35	3.45	3.58	3.74
438	2.99	3.05	3.12	3.17	3.22	3.28	3.35	3.45	3.58	3.74
439	3.00	3.05	3.12	3.17	3.22	3.28	3.35	3.45	3.58	3.75
440	3.00	3.05	3.12	3.17	3.22	3.28	3.35	3.45	3.58	3.75
441	3.00	3.05	3.12	3.17	3.22	3.28	3.35	3.45	3.58	3.75
442	3.00	3.05	3.12	3.17	3.22	3.28	3.35	3.45	3.58	3.75
443	3.00	3.05	3.12	3.17	3.22	3.28	3.35	3.45	3.58	3.75
444	3.00	3.05	3.12	3.17	3.22	3.28	3.35	3.45	3.58	3.75
445	3.00	3.05	3.12	3.17	3.22	3.28	3.36	3.46	3.58	3.75
446	3.00	3.05	3.12	3.18	3.22	3.28	3.36	3.46	3.59	3.75
447	3.00	3.05	3.12	3.18	3.22	3.28	3.36	3.46	3.59	3.75
448	3.00	3.06	3.12	3.18	3.22	3.28	3.36	3.46	3.59	3.75
449	3.00	3.06	3.12	3.18	3.23	3.28	3.36	3.46	3.59	3.75
450	3.00	3.06	3.13	3.18	3.23	3.28	3.36	3.46	3.59	3.75
451	3.00	3.06	3.13	3.18	3.23	3.28	3.36	3.46	3.59	3.75
452	3.00	3.06	3.13	3.18	3.23	3.28	3.36	3.46	3.59	3.75
453	3.00	3.06	3.13	3.18	3.23	3.28	3.36	3.46	3.59	3.75
454	3.00	3.06	3.13	3.18	3.23	3.29	3.36	3.46	3.59	3.75
455	3.00	3.06	3.13	3.18	3.23	3.29	3.36	3.46	3.59	3.75
456	3.01	3.06	3.13	3.18	3.23	3.29	3.36	3.46	3.59	3.76
457	3.01	3.06	3.13	3.18	3.23	3.29	3.36	3.46	3.59	3.76
458	3.01	3.06	3.13	3.18	3.23	3.29	3.36	3.46	3.59	3.76
459	3.01	3.06	3.13	3.18	3.23	3.29	3.36	3.46	3.59	3.76
460	3.01	3.06	3.13	3.18	3.23	3.29	3.36	3.46	3.59	3.76
461	3.01	3.06	3.13	3.18	3.23	3.29	3.36	3.46	3.59	3.76
462	3.01	3.06	3.13	3.18	3.23	3.29	3.36	3.46	3.59	3.76
463	3.01	3.06	3.13	3.18	3.23	3.29	3.37	3.47	3.60	3.76
464	3.01	3.06	3.13	3.19	3.23	3.29	3.37	3.47	3.60	3.76
465	3.01	3.06	3.13	3.19	3.23	3.29	3.37	3.47	3.60	3.76
466	3.01	3.07	3.13	3.19	3.24	3.29	3.37	3.47	3.60	3.76
467	3.01	3.07	3.13	3.19	3.24	3.29	3.37	3.47	3.60	3.76
468	3.01	3.07	3.14	3.19	3.24	3.29	3.37	3.47	3.60	3.76
469	3.01	3.07	3.14	3.19	3.24	3.29	3.37	3.47	3.60	3.76
470	3.01	3.07	3.14	3.19	3.24	3.29	3.37	3.47	3.60	3.76
471	3.01	3.07	3.14	3.19	3.24	3.29	3.37	3.47	3.60	3.76
472	3.01	3.07	3.14	3.19	3.24	3.30	3.37	3.47	3.60	3.76
473	3.01	3.07	3.14	3.19	3.24	3.30	3.37	3.47	3.60	3.76
474	3.01	3.07	3.14	3.19	3.24	3.30	3.37	3.47	3.60	3.77
475	3.02	3.07	3.14	3.19	3.24	3.30	3.37	3.47	3.60	3.77
476	3.02	3.07	3.14	3.19	3.24	3.30	3.37	3.47	3.60	3.77
477	3.02	3.07	3.14	3.19	3.24	3.30	3.37	3.47	3.60	3.77
478	3.02	3.07	3.14	3.19	3.24	3.30	3.37	3.47	3.60	3.77
479	3.02	3.07	3.14	3.19	3.24	3.30	3.37	3.47	3.60	3.77
480	3.02	3.07	3.14	3.19	3.24	3.30	3.37	3.47	3.60	3.77

TABLE A1
(Continued)

Number of Jobs	Percent of Applicants Rejected 0	10	20	30	40	50	60	70	80	90
481	3.02	3.07	3.14	3.19	3.24	3.30	3.38	3.48	3.61	3.77
482	3.02	3.07	3.14	3.20	3.24	3.30	3.38	3.48	3.61	3.77
483	3.02	3.07	3.14	3.20	3.24	3.30	3.38	3.48	3.61	3.77
484	3.02	3.07	3.14	3.20	3.24	3.30	3.38	3.48	3.61	3.77
485	3.02	3.08	3.14	3.20	3.25	3.30	3.38	3.48	3.61	3.77
486	3.02	3.08	3.14	3.20	3.25	3.30	3.38	3.48	3.61	3.77
487	3.02	3.08	3.15	3.20	3.25	3.30	3.38	3.48	3.61	3.77
488	3.02	3.08	3.15	3.20	3.25	3.30	3.38	3.48	3.61	3.77
489	3.02	3.08	3.15	3.20	3.25	3.30	3.38	3.48	3.61	3.77
490	3.02	3.08	3.15	3.20	3.25	3.30	3.38	3.48	3.61	3.77
491	3.02	3.08	3.15	3.20	3.25	3.31	3.38	3.48	3.61	3.77
492	3.02	3.08	3.15	3.20	3.25	3.31	3.38	3.48	3.61	3.78
493	3.02	3.08	3.15	3.20	3.25	3.31	3.38	3.48	3.61	3.78
494	3.02	3.08	3.15	3.20	3.25	3.31	3.38	3.48	3.61	3.78
495	3.03	3.08	3.15	3.20	3.25	3.31	3.38	3.48	3.61	3.78
496	3.03	3.08	3.15	3.20	3.25	3.31	3.38	3.48	3.61	3.78
497	3.03	3.08	3.15	3.20	3.25	3.31	3.38	3.48	3.61	3.78
498	3.03	3.08	3.15	3.20	3.25	3.31	3.38	3.48	3.61	3.78
499	3.03	3.08	3.15	3.20	3.25	3.31	3.38	3.48	3.61	3.78
500	3.03	3.08	3.15	3.20	3.25	3.31	3.39	3.49	3.62	3.78

Note: To calculate expected performance $(\bar{Z}_y)$ for other specified values of R (the validity of the performance estimates) and r (the intercorrelation of the performance estimates), the $\bar{A}_y$ values in the table need to be separated into a selection component $(\bar{A}_{ys})$ and a classification component $(\bar{A}_{yc})$ where both $\bar{A}_y$ and $\bar{A}_{ys}$ are obtained from the table and $\bar{A}_{yc} = \bar{A}_y - \bar{A}_{ys}$. Then compute $Z_y = \bar{A}_{ys}(R) + \bar{A}_{yc}(R\sqrt{1-r})$. Values for the first 10 jobs, are from "Efficiency of Classification as a Function of Number of Jobs, Per Cent Rejected, and the Validity and Inter-correlation of Job Performance Estimates by H. E. Brogden, 1959, Educational and Psychological Measurement, 19, p 181-189. Copyright 1959 by Educational and Psychological Measurement, Inc. Reprinted by Permission.

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